

TOWARDS SUSTAINABLE AGRICULTURE: ASSESSING THE ECONOMIC IMPACT OF ORGANIC FARMS IN MOLDOVA'S AGRICULTURAL SECTOR

Liliana CIMPOIEȘ, Diana COȘALÎC

Academy of Economic Studies of Moldova, 61, Mitropolit Gavriil Banulescu-Bodoni Street, Chisinau, Republic of Moldova, E-mails: lcimpoies@ase.md, cosalic.diana@ase.md

Corresponding author: cosalic.diana@ase.md

Abstract

The Republic of Moldova has made significant strides in adopting organic farming practices, supported by government subsidies and strategic focus on market demand. This paper aims to analyze the economic performance of organic farms in Moldova and their impact on the sustainable development of the agricultural sector, using primary data collected from 63 organic farms benefiting from subsidies between 2020 and 2022. The agricultural sector in Moldova has experienced a gradual increase in cultivated land, with a noteworthy 9.5% dedicated to organic farming. Economically, farmers have seen substantial growth in income per hectare, credited to favorable climatic conditions and advanced technologies. Although organic farming contributes significantly, constituting approximately one-third of total income, conventional agriculture remains the primary contributor with two-thirds. The impact of subsidies from the National Fund for Agricultural and Rural Development is evident in farm development, as calculated profits per one lei of subsidy have surged from 1.51 to 10.43 lei in 2022. This underscores the effectiveness of government support in fostering growth and development within Moldova's agricultural sector, emphasizing a positive trajectory for sustainable agricultural practices

Key words: ecological agriculture, efficiency, economic performance, organic farming, subsidies

INTRODUCTION

Extensive research has been conducted, employing productivity and efficiency analysis, to compare organic farming with traditional agriculture on a large scale. However, uncertainties persist regarding the efficiency and productivity of organic farming. Key questions related to productivity and efficiency studies in organic agriculture have received some answers, and a comprehensive overview can provide empirical evidence to address these queries. Primarily, the extent to which organic farming is less productive than conventional agriculture [3, 6, 13, 16], and whether organic farming can offer solutions to global agricultural development challenges, are fundamental questions. Efficiency and productivity analysis plays a crucial role in contributing to this ongoing debate, delving into variations in productivity at the farm level and identifying the underlying drivers. Secondly, organic farming receives support through diverse policies in the European

Union (EU) and other nations [9, 17, 18, 14]. In certain EU countries, policymakers have even set quantitative targets for the proportion of organic farming in the agricultural sectors of Member States [8, 11, 14]. Literature on efficiency highlights that subsystems have a systematic impact on production decisions, farm efficiency, and productivity [10, 11, 15]. To formulate effective policies, understanding how different types of support affect farm productivity is imperative. Lastly, organic farming operates based on the principles of organic production [17, 18], and its positive impact on biodiversity is well-documented [13]. However, there is a scarcity of empirical studies assessing the effectiveness of organic farms in generating environmental benefits compared to conventional farms. Moldova's agricultural sector remains a vital component of its economy, making a substantial contribution to household incomes, with more than 20% of the workforce, totaling 179.3 thousand people, engaged in agriculture [4, 5]. Although its contribution has shown

little change in recent years, Moldova boasts one of the highest proportions of arable land in Europe, with 74%, and possesses exceptionally fertile black soils.

In the past few years, the traditional agricultural landscape has undergone significant transformations. Crop production has surged by 55.3% between 2018 and 2022. Notably, staple crops with low added value, such as corn, sunflower, and wheat, continue to dominate annual harvests, comprising nearly 80% of the total sown area. Investments have been directed towards expanding the cultivation of horticultural crops and enhancing post-harvest infrastructure, particularly in the wine and fruit sectors.

The growth in cold storage capacity has facilitated increased exports during the off-season, enabling producers and cold storage operators to capitalize on higher prices post-harvest. These developments indicate a positive evolution in Moldova's agricultural sector, reflecting a strategic shift towards diversification and improved post-harvest handling.

In the context of a market-driven economy, economic entities in the Republic of Moldova are increasingly embracing organic farming practices, a trend that significantly influences the agricultural sector. The country has made notable progress in adopting organic farming, spurred by various government subsidies and a strategic focus on sectors with market demand. In 2019, Moldova emerged as one of the first three European nations to transition to organic land, and it stands among the top 20 countries exporting organic products to the E.U. [12].

The substantial demand for organic products in the EU market serves as a catalyst for the growth of Moldova's organic sector. Economic entities in the country are compelled to swiftly adapt to changing market dynamics within the EU, aiming to enhance their competitive standing. This shift towards organic farming not only aligns with global agricultural trends but also positions Moldova as a significant player in meeting the growing demand for organic products in the European market.

This paper aims to analyze the economic performance of organic farms in Moldova and their impact on the sustainable development of the agricultural sector.

MATERIALS AND METHODS

This research aims to assess the economic performance of organic farms in Moldova and examine their influence on fostering sustainable development within the agricultural sector.

To analyze economic efficiency of organic farms, primary data were used. The survey was realized in March-June 2023 and included 63 farms with 19456 hectares of agricultural land, from which 5320 hectares under organic farming (Table 1). The time period included in analysis refers to 2020-2022.

The largest share in the surveyed farms are LLC (73%), followed by family farms (24%). LLC farms manages 89% (17,306.7 ha) of the analyzed agricultural land, of which on 4,671.7 ha is implemented the technology of organic agriculture (87.7% of agricultural land producing organic products).

Table 1. The structure of the sample of organic farms

Variable	Category	Number of farms	Share, %
Region	North	24	51
	Center	32	38
	South	7	11
Legal form	Individual enterprise	1	1.5
	Individual farm	15	24
	LLC	46	73
	JSC	1	1.5
Total area, hectares	<20	18	29
	20-50	11	17
	50-150	12	19
	150-500	11	17
	>500	11	17
Converted area, hectares	<20	23	37
	20-50	11	17
	50-150	20	32
	>150	9	14

Source: author's calculations.

Additionally, secondary data from Agency of Interventions and Payments in Agriculture regarding the allocated subsidies for organic farming were used.

RESULTS AND DISCUSSIONS

In the context of a market economy, agricultural enterprises in the Republic of Moldova are demonstrating a growing interest in adopting organic farming practices, with substantial implications for the agricultural sector. The country has made progress in the implementation of organic farming, stimulated by various government subsidies and a strategic emphasis on sectors aligning with market demand. In 2019, Moldova ranked among the first three European nations to transition to organic farming practices and secured a position among the top 20 countries exporting organic products to the European Union [2, 12].

From 66 surveyed farms, most agricultural land is managed by individual farms - 9.9% (1924.7 ha) and 505.7 ha of it is under organic farming (or 9.5%). By gender analysis, a majority of farms are managed by men (75%) while women lead only 25 percent of all organic farms.

The agricultural land converted to organic farming increased in 2022 comparing to 2020 by 461 hectares, according to the information collected from the surveyed farms.

Analyzing data related to agricultural land uses, in 2022 compared to 2020, the area of agricultural land converted to organic farming increased by 461 hectares. The slow dynamics in the development of organic farming can be due to different factors as:

- the consumption of the local population of local organic agri-food products is insufficiently developed;
- the promotion of domestic organic products on foreign markets is reduced, practically unimportant in terms of gross added value;
- economic entities implementing organic agriculture act on their own without having consultative support in the field;
- ambiguities with inspection and certification bodies demanding high costs for certification of organic products.

Among the 63 economic entities surveyed, only 40% of respondents indicated an increase in agricultural land dedicated to organic practices, while 60% either maintained or reduced their areas under organic farming.

Consequently, out of the total 19,456 hectares of arable land cultivated by respondent farmers, 27.3% (equivalent to 5,320 hectares) are now dedicated to organic farming. This represents a modest 9.5% growth, or 461 hectares compared to the reported figures in 2020 (Figure 1).

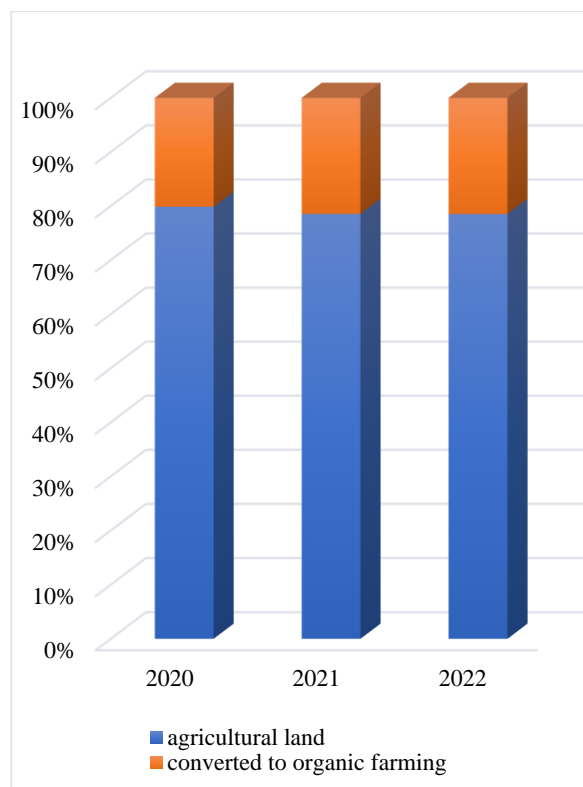


Fig. 1. Share of organic agricultural land in relation to conventional farming

Source: based on farm survey data.

The viability of adopting organic farming practices is at risk, particularly for farms without land ownership. Of 5,320 hectares dedicated to organic crop cultivation, only 16% (amounting to 861.7 hectares) are under secure ownership rights (Figure 2). The remaining 84% of agricultural land is leased from third parties, individuals who acquired ownership rights through the "Land" Program. These landowners retain the option to reclaim the agricultural land at any time if they find the contractual arrangements unsatisfactory. The workforce in the organic farming system varies across economic entities, influenced by factors such as their profile, the extent of managed agricultural land, the nature of agricultural tasks, and the duration of employee training for such activities.

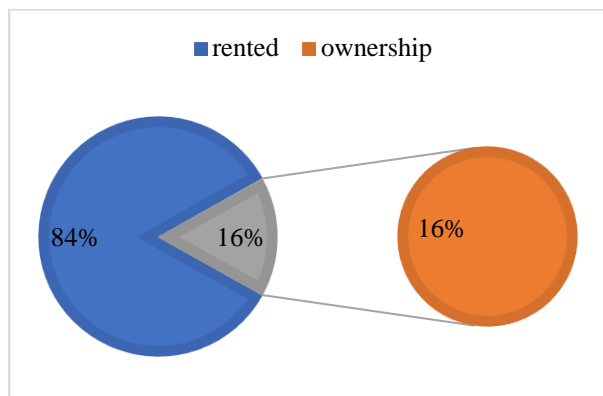


Fig. 2. Share of agricultural land ownership in organic farming, %
 Source: based on farm survey data.

This variance is particularly evident when a significant part of the workforce is employed seasonally in activities like harvesting, processing, and storing the yield. According to the results of surveyed farmers, their workforce comprises both permanent and seasonal employees. Seasonal workers accounted approximately 36% of the total in 2022. In that year, a total of 1,173 individuals were employed, including 864 engaged in regular activities and 309 involved in seasonal work.

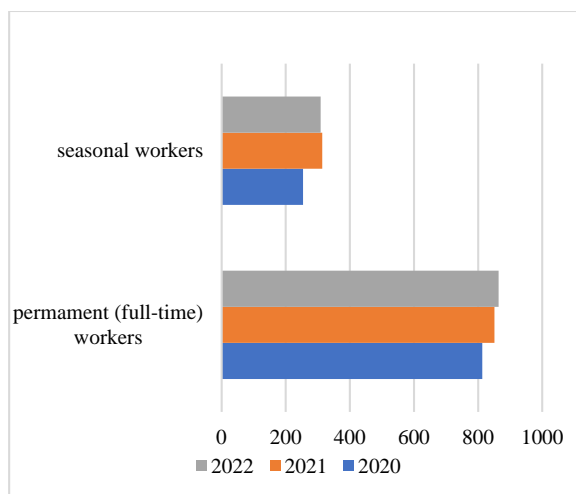


Fig. 3. Persons permanently or seasonally involved in the farm economic activity practicing organic agriculture
 Source: based on farm survey data.

The number of farms permanent employees is primarily influenced by the extent of processed land and the farm complexity. On average, a farm with ownership of 450 hectares of arable land maintains a permanent workforce of around 20 individuals. In

contrast, farms with land ownership ranging from 1 to 100 hectares typically have a permanent staff of up to 6 people (Figure 3). A shared challenge in both organic and conventional agriculture lies in the shortage of qualified personnel. The low interest of younger generations in agriculture, coupled with a preference for alternative fields of activity, poses a pressing issue for farmers. Another crucial indicator of the farm development is their reliance on state support for sectoral growth. In our surveys with farmers, we inquired about their use of subsidies from the Government. Among the 63 respondents, 53 farmers received this support consistently for three consecutive years, 3 benefited for at least two consecutive years, and an additional 4 were subsidized only once, while 3 farmers did not access subsidies at all (Figure 4).

When considering the amount of subsidies obtained, it's noteworthy that these depend on the developed investment projects.

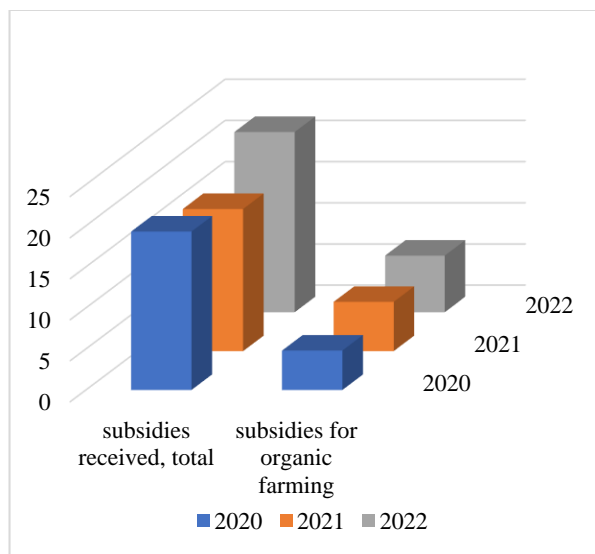


Fig. 4. Subsidies accessed overall versus subsidies for organic farming
 Source: based on farm survey data and AIPA database [1].

A significant majority, 95% of farmers, availed subsidies for the acquisition of agricultural machinery and equipment, as well as for repaying installments on accessed loans. Additionally, 15% of the respondents undertook investment projects focused on establishing multiannual plantations and

equipping them with irrigation facilities, with possible supplementary support. Examining the provided data reveals that the 60 farmers who accessed subsidies executed investment projects valued at 19.3 million lei in 2020, 17.2 million lei in 2021, and 21.9 million lei in 2022. Notably, a significant part, 48 economic entities or 76% of those interviewed, received subsidies in 2022 to bolster the advancement and expansion of organic agriculture in the Republic of Moldova from the National Fund for the Development of Agriculture and Rural Environment. These farmers secured financial support totaling 6.9 million MDL, allocated for purposes such as transitioning to organic agriculture and reimbursing 20% of the value of the sold output (Figure 5).

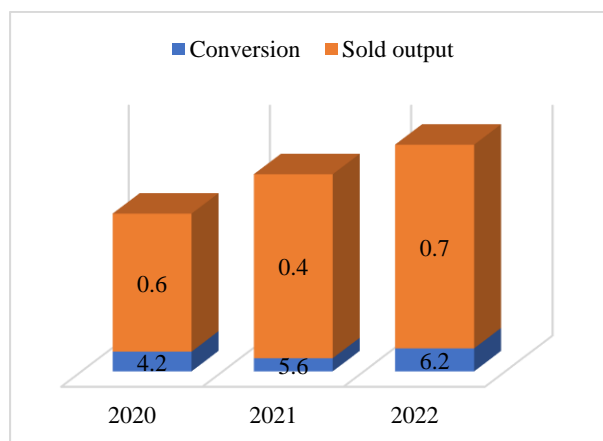


Fig. 5. Subsidies accessed for maintaining organic farming
 Source: based on farm survey data and AIPA database [1].

In general, a trend is observed where more farmers are sustaining organic farming practices, while fewer are expanding their areas for certification. A key criterion for certification by inspection bodies is farmers' adherence to methodological norms of tillage while maintaining the designated areas for organic farming. To meet the requirements, the farmers often engage in land exchanges with other farmers. However, this is acceptable to inspection bodies only if both farmers are implementing organic farming practices.

When asked about whether the Government should tie subsidizing support for agricultural producers to the requirement of endorsing

organic practices, opinions among respondents were divided. Approximately 54% of economic entities, representing 34 farmers, supported this process, while 46%, or 29 farmers, did not support these requirements.

Simultaneously, the respondents highlighted that each farm is urged to adopt specific minimum environmental requirements, which are obligatory to qualify for subsidies. These requirements include:

- obtaining a certain level of crop rotation;
- conservation of permanent pasture;
- maintaining a dedicated field for biodiversity-friendly practices;
- compliance with a farm sustainability tool on nutrient management.

The survey also delved into the farms activity profiles, revealing that the majority of those interviewed (90%) grow cereal crops, while only 10% are involved in activities related to multiannual plantations (Table 2).

Table 2. Area of land and average yield under organic farmers

		2020	2021	2022
Group I cereals	area, ha	1,526.4	1,857.6	2,087.1
	Average yield, tones per year	1,365.0	1,404.6	1,408.3
Group II cereals	area, ha	1,878.2	1,820.1	1,475.3
	Average yield, tones per year	533.8	339.5	202.7
Leguminous crops	area, ha	236.8	134.1	195.5
	Average yield, tones per year	2.5	5.4	4.7
Fruits and berries	area, ha	49.8	49.8	50.1
	Average yield, tones per year	11.6	9.2	34.3
Nuts	area, ha	290.4	426.5	426.5
	Average yield, tones per year	8.3	7.75	11.94
Grape	area, ha	0.2	23.6	36.8
	Average yield, tones per year	25	29	30
Herbs and flowers	area, ha	112.2	135.9	135.9
	Average yield, tones per year	518.9	519	516
Siderat (mustard+peas)	area, ha	764.9	766.3	912.8
	Average yield, tones per year	30.3	101.2	492.8

Source: based on farm survey data.

In 2022, the largest cultivated land area includes cereal crops in Group I, comprising 39.2% or 2,087.1 hectares of the total (Table

2). Within this category, gray holds the primary position at 1,823.3 hectares, followed by rye with 263.8 hectares. Crops in the large cereal category of Group II make up 27.7% of the overall land dedicated to organic farming, totaling 1,475.3 hectares. This category includes sunflower (1,095.9 hectares) and maize (379.4 hectares). Grain legumes and cover crops collectively constitute 20.8% of the organic land share, equivalent to 1,108.3 hectares. Notably, peas are the predominant crop at 682.2 hectares, followed by mustard at 230.5 hectares, and soybeans at 195.5 hectares. These crops, known for their nitrogen-fixing properties, not only enhance soil quality but also contribute to consistent profits for entities specializing in this field.

Farmers are increasingly showing interest in incorporating perennial plantations into the ecological cycle. In 2022, these plantations constitute 9.7% or 513.2 hectares of organic agricultural areas. Notably, walnut crops account for 8% of the organic areas, encompassing 416.9 hectares, while hazelnuts cover 9.6 hectares. Grapes occupy 36.8 hectares or 0.7% of the total area, and fruits (primarily plum) with berries cover 50.1 hectares or 0.9% of the overall land. It's worth mentioning that the area dedicated to nut crops has seen a notable 47% increase in 2022 compared to 2020, attributed to the entry of two additional economic entities into walnut plantation conversion.

In the field of organic farming, achieving successful outcomes for economic entities is contingent upon adhering to rotational practices, given the limited options compared to conventional producers who can utilize synthetic fertilizers and pesticides.

Researchers recommend implementing rotations encompassing several crops over a span of 4 to 6 years. For those prioritizing cereal cultivation, a rotation plan involving alfalfa, maize, peas, and Group I cereals is employed. On the other hand, for farms emphasizing vegetable crops, rotations include cereals and leguminous crops to enhance soil nitrogen content.

From an economic standpoint, pricing is influenced by two key factors: controllable and uncontrollable. Controllable factors are

within the area of management decisions and actions, while uncontrollable factors are external variables that economic entities may have limited influence over.

Controllable factors can be manipulated in one form or another, or the economic entity can have a well-determined price policy and when a risk occurs, it reacts very promptly. As a rule, among the controlled factors are expenditure on materials, staff costs, other expenditures (transport, commissions, advertising, promotion), administration or management expenses.

Uncontrollable factors are those that the economic entity has no leverage of influence. De facto these are supply and demand in the market.

Both controllable and uncontrollable factors progress over time with different developments and require ongoing monitoring by the entity's administration.

The cost of production represents the overall expenses borne by an economic entity to acquire a product. At the entity level, the cost price serves multiple purposes, including: calculating economic and financial indicators for the entity; serving as the foundation for determining production levels and setting the marketing price; facilitating negotiations for production supply contracts; playing a pivotal role in decision-making processes at the management level of the entity.

The production costs within the examined organic farming entities exhibit year-to-year variability, influenced by fluctuations in input prices (such as fertilizers, seed material, diesel, etc.) and the resultant productivity levels. The year 2020 posed significant challenges for farmers, with natural disasters, specifically drought and hail, significantly impacting agricultural crop yields. Consequently, marketing prices also experienced fluctuations. For instance, farmers reported expenses of 6 MDL per kilogram of wheat, yet the final product was sold at an average price of 4.2 MDL per kilogram. In contrast, soybeans were sold at 5.75 MDL per kilogram, surpassing the production cost by 2.1 times.

Based on the survey data, we can mention that leguminous vegetables, mustard, fruits,

grapes, and berries are being sold at prices surpassing the cost of production. This indicates that economic entities engaged in the production of these products are experiencing a positive economic return within their operations.

To support economic entities in agriculture, the Government extends support through compensations or financial aid for harvest losses due to adverse conditions. In 2020, Government Decision no. 582/2020 was enacted [7], outlining a mechanism to provide compensations for mitigating the consequences of natural disasters affecting the 2020 harvest. An allocation of 324.0 million lei from the Reserve Fund of the Government facilitated this initiative. Compensation was directed to farmers who incurred significant damage, as verified by factual evidence. Specifically, compensation was granted for drought-related losses on cereal crops of the first group and hail-induced damages on horticultural crops and peas, provided that the degree of damage exceeded 60%.

Organic farming constitutes a worldwide approach to agricultural management and food production. It integrates optimal environmental practices into a production system that promotes the well-being of soils, ecosystems, and individuals. At its core, organic farming seeks to ensure that farmers not only uphold sustainable practices but also derive a profitable return from their efforts.

The collected data from the surveyed farmers shows variable income during the researched period. Analyzed income data of 63 farms demonstrates a decrease in 2022 by 4.1% compared to the results of 2021 (74.5 million lei). Incomes increased with 87.6% or 819.9 million MDL compared to the results obtained by farmers in 2020.

In essence, a firm's income refers to the financial inflow generated during a management period through its regular operations. This encompasses gross income derived from the sale and collection of products as well as income from other activities.

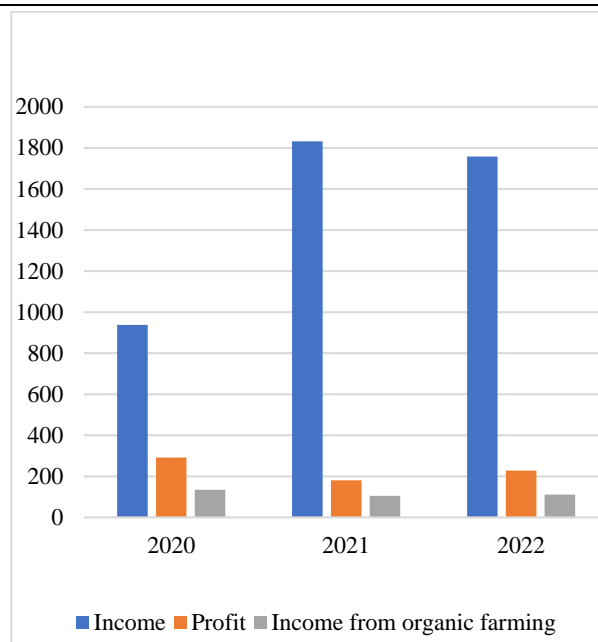


Fig. 6. Financial results recorded by economic entities in organic agriculture, million MDL

Source: based on data from the surveyed farms.

Analyzing the provided data reveals that the surveyed economic entities report revenues not solely from organic agriculture but also from various other activities, such as conventional agriculture and other sources.

It is noteworthy that the declared incomes from organic agriculture constitute only a part of the total income, with 7% representing the earnings derived specifically from the marketing of organic products. In 2022, revenues from organic agriculture exhibit a 5.5% increase compared to those in 2021, amounting to 5.8 million lei. However, when compared with the figures from 2020, these revenues have experienced a decline of 123.4 million lei, equivalent to a 17% decrease. These variations can be attributed to several factors, including: crop rotation practices; climatic conditions, notably the impact of drought in both 2020 and 2022, influencing the production output, which, despite challenges, could be sold at an increased value; opportunities for exporting agricultural production, among other considerations.

Regarding the satisfaction level with the income derived from their managed activities: -56.4% of respondents indicated that they perceive the magnitude of their income as very low.

14% mentioned that the income obtained in 2022, considering both their primary activity and organic farming, is low.

-28% of respondents classified the size of their income as average.

-1.6% mentioned that the income obtained in 2022, combining their primary activity and organic farming, is high.

-None of the respondents expressed the view that the income generated is very high.

To assess the influence of organic farming on the economic activity of farms, it is essential to conduct an economic efficiency analysis focusing on the land areas managed by the surveyed entities. Economic efficiency serves as a key indicator that not only highlights the evolution but also reflects the advancements achieved by the farms.

Table 3. Economic efficiency of farms implementing organic farming practices

Indicators	YEARS		
	2020	2021	2022
Agricultural area, ha	19,271.0	19,082.0	19,456.0
Agricultural area under organic farming, ha	4,858.9	5,213.9	5,320.0
Number of workers, persons	813	851	864
Subsidies, thousand MDL	19,338.4	17,266.8	21,916.3
Subsidies obtained for the implementation of organic farming practices, thousand MDL	4,809.9	6,028.2	6,919.5
Income, thousand MDL	937,901.0	1,832,249.0	1,757,769.0
Income from organic agriculture, thousand MDL	83,460.2	105,362.3	111,174.8
Profit, thousand MDL	29,176.4	180,313.0	228,617.2
Income to 1 hectare, MDL	48,669.0	96,019.8	90,345.9
Income from organic farming practices per ha, MDL	17176.8	20,207.9	20897.5
Profit per 1 ha, MDL	1,514.0	9449.4	11,750.5
Profit calculated to 1 MDL of allocated subsidies, MDL	1.51	10.44	10.43
Organic farming income in total income, %	35.3	21.1	23.1

Source: based on data from the surveyed farms.

Based on the provided data about economic efficiency in farms implementing organic farming practices (Table 3), it is observed that the land areas cultivated by farmers show a gradual increment each year, ranging from a 1% overall growth in the total agricultural land worked to a 9.5% expansion specifically

in the agricultural land designated for organic farming practices. Additionally, there is a 6.3% increase in the number of employees in 2022 compared to 2020. When considering the area worked, this translates to an index of 0.04 employees per hectare of agricultural land managed by the surveyed farmers.

To identify economic efficiency, we analyzed farm income per land area. Thus, per 1 ha of agricultural land worked within the agricultural holding, the farmers income in 2020 amounted to 48.7 thousand MDL and in 2022, it increased to 90.3 thousand MDL. These developments were 1.9 times caused by favorable climatic conditions compared to the technologies applied by farmers in 2022, or, in 2020, the Republic of Moldova was affected by natural calamities expressed both by severe drought and hail. The income obtained by farmers from organic farming is lower compared to the total income, however from organic farming surveyed, farmers obtained 1/3 of it and from conventional agriculture 2/3.

Analyzing the profit calculated at 1 MDL subsidies accessed by farmers, we can mention that the support granted to farmers from the National Fund for the Development of Agriculture and Rural Environment has a major impact on business development, so that their evolution is obvious, or, in 2020, 1 MDL of the subsidies accessed led to obtaining 1.51 MDL profit and in 2022 to 10.43 MDL profit.

CONCLUSIONS

In the context of a market economy, the Republic of Moldova is witnessing a growing interest among economic entities towards adopting organic farming practices, significantly impacting the agricultural sector. The country has made substantial progress in organic farming, stimulated by government subsidies and strategic alignment with market demand. Moldova earned recognition in 2019, ranking among the first three European countries to transition to organic farming and securing a spot in the top 20 countries exporting organic products to the European Union.

Among the surveyed farms, individual farms manage the majority of agricultural land, with 9.5% dedicated to organic farming. Gender analysis reveals that men lead 75% of all farms, while women manage the remaining 25%, emphasizing gender disparities in organic farming leadership.

Despite facing challenges such as insufficient local consumption of organic products and limited promotion of domestic organic goods in foreign markets, organic farming in Moldova has seen a slight increase. The conversion of agricultural land to organic farming grew by 461 hectares in 2022 compared to 2020. However, this slow development may be attributed to factors like the lack of consultative support for entities implementing organic agriculture and uncertainties related to inspection and certification bodies, imposing high certification costs.

An analysis of economic efficiency indicates a variable income among surveyed farms. While organic farming revenues constitute a smaller portion of the total income, they have increased by 5.5% in 2022 compared to 2021. Leguminous vegetables, mustard, fruits, grapes, and berries are notable for being sold at prices exceeding production costs, indicating positive economic returns for entities engaged in their production.

Government support plays a crucial role in sustaining agriculture, as seen in compensations and financial aid provided for natural disaster-related harvest losses. Subsidies from the Government have supported farmers in various investment projects, with a significant focus on acquiring agricultural machinery and equipment.

The challenges faced by organic farming include land ownership issues, with only 16% of organic land under secure ownership rights. Additionally, the shortage of qualified personnel poses a common challenge in both organic and conventional agriculture, driven by waning interest among younger generations in pursuing careers in agriculture. Despite the challenges, a positive trend is observed where more farmers are sustaining organic farming practices. However, fewer are expanding their areas for certification. The

government's role in tying subsidizing support for agricultural producers to organic practices is met with divided opinions among respondents.

In conclusion, while Moldova has made strides in organic farming, there are ongoing challenges related to market development, land ownership, and workforce shortages. Government support remains crucial, and efforts to address these challenges can further enhance the sustainability and growth of organic farming in the country.

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